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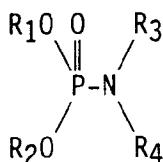
Amino alkyl phosphonate as antiwear additive for lubricant containing hydrophylic basestock.

Lubricants containing hydrophilic basestocks (e.g., water-based lubricants or organic-based lubricants with polyalkylene glycol basestocks containing free hydroxy groups) can be formulated with an amino alkyl phosphonate antiwear additive.

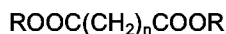
BACKGROUND OF THE INVENTION

A variety of organophosphorus compounds either alone, reacted with, or in admixture with other compounds have been suggested as lubricant additives in the following prior art disclosures, for example:

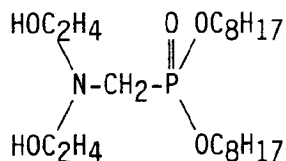
- (1) U.S. Patent No. 3,553,131 discloses use of a mixture of an organic phosphonate and an organic amine;
 - (2) U.S. Patent No. 4,077,892 mentions the reaction of a partially esterified multifunctional alcohol with a phosphorus trihalide or a dihydrocarbyl phosphonate;
 - (3) U.S. Patent No. 4,228,020 shows the combination of graphite and a di-lower alkyl hydrocarbyl phosphonate;
 - (4) U.S. Patent No. 4,231,781 teaches use of halophenoxy-alkoxy phosphonates as lubricants or lubricant additives;
 - (5) U.S. Patent No. 4,664,828 relates to the use of certain hydrogen phosphonates as additives in certain water-based fluids;
 - (6) U.S. Patent No. 5,059,335 teaches the use of hydroxyalkane phosphonic acids and derivatives as antiwear and extreme pressure additives in lubricants;
 - (7) French Patent No. 1,566,028 shows the use of certain phosphorus compounds as sludge control agents in functional fluids; and
 - (8) British Patent No. 748,137 shows the use of an ester or metal salt of a hydroxy phosphonic acid in lubricating oils.
- British Patent No. 899,101 shows that amino-phosphonates of the formula



where R_1 and R_2 can, for example, be alkyl and R_3 and R_4 can also be alkyl, are useful as load-carrying additives in certain diester basestocks of the formula



where n is from 4 to 14 and R is C_4 - C_{18} alkyl. These lubricants are hydrophobic in nature rather than hydrophilic. Most recently, U.S. Patent No. 5,124,055 shows lubricating oil compositions comprising an oil of suitable lubricating viscosity and a co-sulfurized blend of soybean oil and an ester, amide, ester-amide, or fatty amine derivative containing at least one substituent group. One class of suitable amines can be prepared by reacting a dialkyl phosphate with formaldehyde and a dialkanol amine to yield the following type of product:



SUMMARY OF THE INVENTION

The present invention relates to lubricants comprising a hydrophilic basestock which also comprise an amino alkyl phosphonate as an antiwear additive. A preferred amino alkyl phosphonate is an O,O-dialkyl N,N-bis(hydroxyalkyl) amino methyl phosphonate.

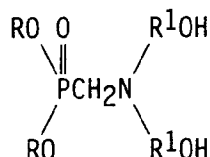
DETAILED DESCRIPTION OF THE INVENTION

The lubricant compositions to which the present invention relates are those which contain hydrophilic basestocks. The term "hydrophilic basestock" as used herein is intended to cover non-petroleum and non-organic, hydrophilic basestocks and be inclusive of both water-based lubricants, which may contain hydrophilic associative thickeners (such as nonionic polyalkylene glycol), and those lubricants containing an organic molecule as the basestock component, such as polyalkylene glycols containing free hydroxy groups. Such types of lu-

bricants are well known to persons of ordinary skill in the art and are useful, for example, as hydraulic fluids and lubricants (e.g., polyalkylene glycol-based products) or as chain lubricants and metal working fluids (e.g., water-based lubricants).

The present invention relates to the use of an effective amount of an amino alkyl phosphonate in such type of lubricants as an antiwear additive. Generally speaking, it is contemplated that the amount of this type of phosphonate additive can range from about 0.1% to about 10%, by weight of the lubricant, preferably from about 0.2% to about 2%.

The preferred type of amino alkyl phosphonate for use herein is an 0,0-dialkyl N,N-bis(hydroxyalkyl) amino methyl phosphonate of the formula



where each R can be the same or different and are alkyl groups, preferably C₁ to C₄ alkyl groups, and each R¹ can be the same or different and are alkylene groups, preferably C₁ to C₄ alkylene groups. A more preferred material for use in the present invention is 0,0-diethyl N,N-bis(2-hydroxyethyl) amino methyl phosphonate which is available commercially under the trademark FYROL® 6 from Akzo Chemicals Inc.

In addition to the aforementioned types of basestock and phosphonate, the lubricant compositions intended by the present invention can contain other functional additives known to persons of ordinary skill in the art.

The present invention is further illustrated by the Examples which follow.

EXAMPLES 1-8

These Examples illustrate four ball wear test data for a number of compositions containing hydroxyl-containing and acetate ester-containing polyglycol lubricants. The four ball test was conducted at 600 rpm for one hour at 54°C using a 40 kg load. The various ingredients described in the data given below are:

Polyol A: a multifunctional polyether polyglycol containing terminal hydroxyls having CAS No. 025791-96-2. It was a viscous liquid having a specific gravity of 1.033.

Polyol B: a multifunctional polyether glycol in which the terminal hydroxyl groups of Polyol A have been converted to the corresponding acetate ester. It has CAS No. 76308-92-4.

FYROL® 6 brand: a commercially available flame retardant, 0,0-diethyl N,N-bis(2-hydroxyethyl) amino methyl phosphonate, from Akzo Chemicals Inc.

DAPRAL® GE 202 brand: a commercially available thickener, from Akzo Chemicals Inc., which is a partial ester of a branched carboxylic acid copolymer having a comb-like structure with an average molecular weight of 20,000. The main chain consists of carbon atoms only, the alkyl branches are hydrophobic, and the ester and ether groups are hydrophilic.

SYN-O-AD® 8478 brand: is a commercially available lubricant additive, tert-butylphenyl diphenyl phosphate ester from Akzo Chemicals Inc.

In the wear test data which follows, a lower wear scar reading is more desirable:

Test No.	Composition	Wear Scar (mm)
1**	Polyol A -- 100%	0.57
2**	Polyol B -- 100%	0.60
3	Polyol A -- 99%	
	FYROL® 6 brand -- 1%	0.44
4**	Polyol B -- 99%	
	FYROL® 6 brand -- 1%	0.75
5	Polyol A -- 94%	
	DAPRAL® GE 202 brand -- 5%	
	FYROL 6 brand -- 1%	0.36
6**	Polyol A -- 99%	
	SYN-0-AD® 8478 -- 1%	0.68
7**	Polyol A -- 95%	
	DAPRAL® GE 202 -- 5%	0.57*
8	Polyol A -- 94%	
	DAPRAL® GE 202 -- 5%	
	FYROL® 6 -- 1%	0.39*

* The blend was heated for two hours before the wear test.

** Not part of the invention. Presented for comparison purposes only.

A comparison of the results of Test Nos. 3 and 4, above illustrates the importance of using a hydrophilic lubricant basestock (Polyol A) as compared to one in which a hydroxyl group, for example, is replaced with a less hydrophilic group, such as acetate (Polyol B). Test No. 6 illustrates the inferior results obtained using a conventional hydrocarbon additive, whereas Test No. 7 illustrates the lack of positive effect using a conventional thickener.

EXAMPLES 9-12

These Examples illustrate the use of the present invention in a water-based conveyor chain lubricant. A composition was formulated comprising deionized water and 5% of a non-ionic polyalkylene glycol thickener having a molecular weight of 3000, which is commercially available under the trademark DAPRAL® GT 282 from Akzo Chemicals Inc. A four ball wear test was conducted at 75°C, 40 kg load, for one hour at 1800 rpm. The test, which was quite noisy, was only conducted for one-half hour and was terminated. The scar was 2.6 mm.

A series of blends were then formulated as described below under similar conditions and the following wear

data was obtained. In the tests the following new ingredients, as compared to those used in Examples 1-8 were used:

DAPRAL®712 brand: a commercially available thickener which is an ester of a branched carboxylic acid copolymer having a comb-like structure with an average molecular weight of 7,000 from Akzo Chemicals Inc.

VICTAWET® 12 brand: a nonionic phosphate ester surfactant from Akzo Chemicals Inc.

The results are as follows:

Test No.	Composition			Wear Scar(mm)
9	Water/DAPRAL® GT 282 brand	--	99%	
	FYROL® 6 brand	--	1%	0.85
10	Water/DAPRAL® GT 282 brand	--	97%	
	DAPRAL® 712 brand	--	1%	
	VICTAWET® 12 brand	--	1%	
	FYROL® 6 brand	--	1%	1.14
11	Water/DAPRAL® GT 282 brand	--	98%	
	FYROL® 6 brand	--	2%	1.23
12	Water/DAPRAL® GT 282 brand	--	97%	
	VICTAWET® 12 brand	--	2%	
	FYROL® 6 brand	--	1%	0.92

The foregoing Examples should not be construed in a limiting sense since they are merely intended to illustrate certain embodiments of the invention. The scope of protection sought is set forth in the claims which follow.

Claims

1. A lubricant composition comprising a hydrophilic basestock selected from the group consisting of water-based basestocks containing hydrophilic associative thickeners and organic molecule-containing basestocks, and an effective amount, as an antiwear additive, of an amino alkyl phosphonate.
2. A lubricant as claimed in Claim 1 wherein the amount of phosphonate is from 0.1% to 10%, by weight of the composition.
3. A lubricant as claimed in any one of Claims 1-2 wherein the amino alkyl phosphonate is an 0,0-dialkyl N,N-bis(hydroxyalkyl) amino methyl phosphonate.
4. A lubricant as claimed in Claim 3 wherein the alkyl moieties are C₁ to C₄ alkyl.
5. A lubricant as claimed in Claim 4 wherein the alkyl moieties are ethyl.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 0064

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	WO-A-91 18073 (THE LUBRIZOL CORPORATION) * page 9, line 5 - line 9 * * page 14, line 4 - line 5 * * page 16, line 4 - line 6 * * page 20, line 6 - line 13 * ---	1,2	C10M137/12 C10M169/04 C10M173/02 //C10N30/06, (C10M173/02, 137:12)
X	US-A-4 563 299 (G.FRANGATOS) * column 2, line 16 - line 44 * * column 3, line 55 * * column 4, line 5 * ---	1,2	
X	FR-A-1 222 104 (CIBA) * page 3, column 2, line 8 - line 11 * ---	1	
X	US-A-4 260 499 (R.S.FEIN) * column 5, line 25 - line 28; claim 1 * ---	1,2	
A	US-A-2 635 112 (E.K.FIELDS) * column 1, line 12 - line 30 * * column 9, line 23 - line 25 * ---	3-5	
A	US-A-3 498 969 (M. LEWIS) * column 1, line 29 - line 30 * * column 3, line 49 - line 50 * ---	1-5	TECHNICAL FIELDS SEARCHED (Int.Cl.5) C10M C07F
D,A	EP-A-0 335 701 (ETHYL PETROLEUM ADDITIVES) * page 2, line 14 * * page 2, line 34 - line 45 * ---	1-5	
A	DATABASE WPI Section Ch, Week 9214, Derwent Publications Ltd., London, GB; Class E16, AN 92-112250 & SU-A-1 659 456 (URALS PIPE IND RES) 30 June 1991 * abstract * -----	1,2	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 April 1994	Examiner Hilgenga, K
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.92 (P04C01)